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The Herpetology of the Boulder Dam Region (Nev., Ariz., Utah)

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INTRODUCTION

Through research funds provided by the University of California at Los Angeles, the writers were able to undertake a survey of the reptiles and amphibians occurring in the region of the new Boulder Dam.*

During the spring of 1935, the flow of the Colorado River was first brought under control, and the vast reservoir** behind the dam began to fill rapidly. For a time, when the flood waters of spring were pouring down the river, the surface of the reservoir rose a few feet every twenty-four hours. In the course of a month or so vast areas, formerly desert, were submerged. Temporary islands were produced; mouths of washes became lagoons.

It was the original anticipation to take advantage of such a unique situation in the Mojave Desert, for it seemed certain that as islands were formed, and gradually neared oblivion, there would be concentrations of reptiles (and mammals) on them. This was borne out in fact by the work of Mr. A. E. Borell of the Wildlife Division of the National Park Service, who spent four days collecting, chiefly on temporary islands, during the month of May. He secured sixty-five specimens of reptiles and amphibians.

*. In the interests of posterity, it should be noted that the name "Hoover Dam" was applied by a previous administration to the same structure. Cf. Klauber, Copeia No. 3, 1932, pp. 118-128.

**. Now officially designated "Lake Mead".

Unfortunately, in the early part of July, by the time the actual work of collecting began, the reservoir nearly had ceased rising and the diurnal temperature in the region had risen to something over 100°F., falling but little below this at night. These two factors precluded any great success so far as collecting on isands was concerned. Animals unable to find shelter, either were easy prey for predators or had been forced by the heat to take to the water, where apparently they drowned or swam ashore. According to stories of men engaged in work on the reservoir, snakes were not infrequently seen in the water (no snakes of the genus *Thamnophis* have been recorded from the region) in spring. In the early part of July a rattlesnake, found swimming in the reservoir near Pierce's Ferry, was taken by one of the men working for the government.

Thus, collecting conditions were poor, and although the period between July 8 and August 7 was spent in the field by the junior author, a total of only 410 specimens of reptiles and amphibians was secured. This includes specimens taken in the Charleston Mountains, Clark County, Nevada, August 7 to 13, and Zion National Park where collecting was done under more favorable conditions between the dates of August 16 and 21. A certain amount of time was taken to secure representatives of the fish, mammals, and birds of the region, although such collecting was incidental and not extensive.

In a subsequent paper it is proposed to present further data of an ecological nature, and the present annotated list of forms collected is primarily a preliminary publication of distributional and taxonomic interest.

It becomes necessary to explain some terms used in the following list of localities where specimens were taken. For lack of better designation, two islands that were in existence during the months of July and August, 1935, near the mouth of Hemenway Wash, Nevada, have been called islands Nos. "1" and "2," respectively, No. 2 being larger and farther from the shore. The name "Island No. 3" is used to designate a larger area of land covering several acres of rocks and sand which rise sufficiently high so that the summit will forever remain an island when the reservoir is full. Before the reservoir began filling, this elevated land was located on the Nevada side of the Colorado River, approximately a mile above the upper entrance to Black Canyon wherein the dam is located. No reptiles were found on any of the numerous smaller islands visited. For the sake of clearness it might be well to remind readers that the east and west walls of Black Canyon lie in Arizona and Nevada, respectively.

The majority of the collecting was done around the southern portion of the reservoir, although one trip was made by boat into the lower recesses of Grand Canyon as far as the Flour Sac Rapids, which were at the time (August 31, 1935) a little beyond the upper end of the reservoir water level.

In presenting this paper, it gives the writers pleasure to express their thanks to the officials of the Bureau of Reclamation, and the officials of Six Companies, Inc., at Boulder City who extended their cooperation. Thanks are likewise due the following: Mr. M. G. Netting, whom the junior author had the pleasure of meeting in Zion National Park, and who kindly offered suggestions regarding certain amphibians; to Mr. L. M. Klauber for several courtesies including the loan of comparative material; to Mr. A. E. Borell, who generously supplied data he secured at the reservoir in May; and lastly, to Mr. Ben Ayers and Mr. Harold Coe of Boulder City, Nevada, who gave much assistance in collecting. Mr. Murl Emery of the Boulder City Navigation Company has our appreciation for his assistance in the matter of transportation.

A List of the Amphibians and Reptiles From the Region of Boulder Dam, Including Adjacent Areas in Nevada, Arizona, and Utah

AMPHIBIANS

Scaphiopus hammondii Baird—Despite the fact that Woodbury* questions Tanner's record of the spadefoot toad in Zion Canyon (1927:54), Mr. M. G. Netting and the junior author collected over a dozen adults in the course of two hours' work by flashlight on the night of July 20 These were collected in and along the small stream which flows out of "The Grotto." Four of these specimens are in the U. C. L. A. collection.

Bufo compactilis Wiegmann—Owing to morphological variation in individuals of this species and *B. w. woodhousii* and the confusing similarity of the adults of the two species, there appears to be some question concerning the identification of the toads reported previously from some of the localities in the region. Examination of various keys and descriptions of these amphibians serves only to confuse the situation, although it is not doubted that the two species are distinct. Despite the fact that *woodhousii* is the species previously reported from Zion National Park, the series of specimens collected there would appear to be closer to *compactilis*. Mr. M. G. Netting who obtained a series of these toads from Zion Canyon, writes that his "specimens from Zion have some of the characters of both species." Further study may possibly indicate that the Zion Canyon toads are a distinct race. Specimens from the following

*. The Amphibians of Zion National Park, by A. M. Woodbury, 1930. Mimeographed list prepared by the United States National Park Service.

localities have been tentatively identified as *compactilis*

Utah:	Toquerville	(1)	Nevada:	Island No. 3	(2)
	Leeds	(1)		El Dorado Canyon	
	Anderson's Junction	(2)		Mouth Hemenway	
	Rockville	(2)		Wash.	(6)
	Springdale	(1)			
	Zion Canyon	(14)			

Bufo punctatus BAIRD & GIRARD—Specimens of this toad were taken on a rainy night between St. George and Zion National Park; and on the new reservoir they were found clinging to driftwood at the mouth of Boulder Wash.

Utah:	Toquerville	Nevada:	Mouth of Boulder Wash,
	Rockville		Colorado River

Bufo woodhousii woodhousii GIRARD—What appears to be a typical specimen was secured in Utah at Orderville. A second and smaller specimen, less typical, was secured on the Virgin River at Mesquite, Nevada.

Hyla arenicolor COPE—Nine adults were taken in Zion National Park at Upper Emerald Pool. Larvae were abundant in the stream leading from the pool.

Hyla regilla BAIRD & GIRARD—These small tree toads were seen at only one locality, the stream of artesian well origin which runs through Las Vegas, Nevada. They were not especially abundant.

*Rana onca** COPE—This species was first observed at the mouth of Boulder Wash, Colorado River, where the rising waters of the reservoir had submerged a small cat-tail swamp. Two specimens were seen clambering about on small bits of driftwood a few feet from the bank. One specimen was collected at Littlefield, Arizona, and five specimens were taken on the Muddy River at Glendale, Nevada. Although Woodbury (1930) has recorded *R. pipiens* from Zion Canyon on the Mukunteweap River, a tributary of the Virgin, it would seem improbable that two such closely related species as *onca* and *pipiens* would occur in contiguous regions of the same drainage system. More recently, Eaton** has stated that specimens collected further eastward in Utah are "intermediate" and he doubts the validity of *onca*. It is more probable that, if not valid species, the two forms may be subspecific.

*. Bullfrogs, Rana catesbeiana, according to numerous verbal accounts of residents, have been introduced in the swamps and meadows resulting from the artesian wells in the vicinity of Las Vegas, Nevada. In the course of two hours' work in the vicinity of a swamp one mile west of Las Vegas, no bullfrogs were seen. A large frog dived into deep water flowing beneath a culvert and disappeared. It may have been a bullfrog which residents distinguish from the native Rana onca previously reported from the locality. No onca were observed, which might be accounted for on the basis of the theory that the species probably introduced is notoriously cannibalistic.

**. Copeia, 1935:150.

LIZARDS

Coleonyx variegatus (BAIRD)—Specimens of the banded gecko were discovered by prying off rocks at the following localities in Nevada: Mouth of Kyle Canyon, Charleston Mountains, elevation 4,000 ft.; on a temporary island near the Boulder City boat landing just north of Black Canyon; Mouth of Boulder Wash. An adult female was found crossing the highway at Littlefield, Arizona, in the early evening.

Dipso-saurus dorsalis dorsalis (BAIRD & GIRARD)—The most frequently seen of any lizard along the edges of the reservoir north of Black Canyon. In many cases they were found in the water clinging to the rocks along the shores on the islands. Specimens were taken at the following localities:

Nevada:	Hemenway Wash	(2)	Arizona:	1 mile north of Black Canyon	(7)
	Island No. 2	(5)			
	" No. 3	(9)			
	Las Vegas Wash	(2)			
	Boulder City	(1)			

Crotaphytus collaris (SAY)—A species taken around rock piles at the following places:

Nevada:	Mouth of Las Vegas Wash	Utah:	Springdale
	Mouth of Boulder Wash		
	The Pass, (near Boulder City)		

Crotaphytus wislizenii BAIRD & GIRARD—15 specimens, all taken along the stream that flows out of the Boulder City sewage disposal plant. Most of them are juveniles taken in August.

Sauromalus obesus (BAIRD)—Taken in rock areas in the following localities:

Nevada:	Boulder Wash	(1)	Utah:	St. George	(1)
	Las Vegas Wash	(1)			
	Island No. 3	(4)			
	Island No. 2	(4)			
	Boulder Dam	(1)			

Callisaurus draconoides ventralis (HALLOWELL)—Taken at the following localities:

Nevada:	Mouth of Hemenway Wash	(4)	Arizona:	1 mile no. of Black Canyon	(1)
	Boulder Wash	(1)		West Slope, Fortification Mountain	(2)
	Boulder City	(7)			

Uta graciosa (HALLOWELL)—For some unaccountable reason this species was found only at Boulder City. They were especially common in creosote bushes bordering the stream leading from the Boulder City sewage disposal plant where 72 specimens were collected in one evening. A total of 98 specimens from this one locality were preserved. A diligent but fruitless search was made for this lizard in the southwestern corner of Utah.

Uta ornata symmetrica BAIRD—The habitat of this lizard appear-

ed to be confined almost entirely to the steepest canyon walls. Specimens were taken at:

Nevada:	Black Canyon	(3)	Arizona:	Black Canyon	(17)
	El Dorado Canyon	(3)		Travertine Springs mouth of Grand Canyon	

Uta stansburiana stansburiana BAIRD & GIRARD—In spite of the fact that this small *Uta* is out at all times of the day and practically ubiquitous in its distribution it is not easily collected owing to its size and habits. It is exceedingly difficult to noose, and not satisfactorily killed with ordinary .22 dust shot under normal conditions, since even the .22 is sufficiently powerful to procure only badly mangled specimens. Chiefly for these reasons, no special effort was made to secure any large number of specimens. The following were secured:

Nevada:	Boulder City	(5)	Arizona:	1 mile north of Black Canyon	(1)
	Boulder City Boat Landing	(1)			
	Mouth of Boulder Wash	(1)			
	Charleston Mts. (Kyle Canyon) El. 4,000 ft.	(2)			

Sceloporus elongatus STEJNEGER — Twenty-three specimens were collected in Zion Canyon, Utah. They occur chiefly in the lower regions of the canyon, occupying the same habitat as *Sceloporus g. graciosus* except for the fact that *elongatus* is more frequently found on rocks. Both species may be observed together, apparently competing for the same food, on driftwood logs, dead trees, and about human habitations.

Sceloporus graciosus graciosus BAIRD & GIRARD—This sub-species was taken on the floor of the canyon in Zion National Park and in the Charleston Mountains, where it was observed to inhabit the Transition Zone, overlapping in range into the Upper Sonoran and Canadian Zones between the elevations of 5,000 and 8,000 feet. Taken only at the following two localities:

Nevada:	Charleston Park, Charleston Mts.	(14)	Utah.	Zion National Park	(11)

Sceloporus magister magister HALLOWELL — Three specimens were taken in the lower end of Kyle Canyon in the vicinity of a grove of joshua trees (*Yucca brevifolia*) at an elevation of approximately 4,000 feet. In a collection made by one of the members of the Civilian Conservation Corps, then located in the Charleston Mountains, was a specimen taken at Overton, Nevada.

Sceloporus occidentalis bi-seriatus HALLOWELL—A series of 12 specimens was secured in the Charleston Mountains at Kyle Canyon and Harris Spring between the elevations of 4,000 and 6,000 feet.

Phrynosoma platyrhinos platyrhinos GIRARD—A species surprisingly uncommon in a region presumably its normal habitat. Its scarcity in summer suggests that it aestivates during the hotter part of the

year. One specimen was collected at 8 P. M. on July 21, at a time of day when there was barely sufficient light to discover the reptile; it undoubtedly would have gone unnoticed had it not moved.

Nevada: Boulder City (4)
Mouth of Boulder Wash (1)

Heloderma suspectum COPE—This largest of our native lizards is rarely seen in summer; and in Nevada it appears to be far from common under favorable conditions. There were reliable accounts of its occurrence in Boulder City, and at the Las Vegas High School was a specimen taken near that city where it has been previously reported. In a collection taken by a member of the Civilian Conservation Corps at Overton (on the Virgin River in Nevada) was a medium-sized Gila monster well preserved in formalin. The owner advised me that it had been secured in May and was the only individual seen by members of the camp.

Xantusia vigilis BAIRD—Six of these night lizards were secured in the vicinity of the Kyle Canyon road at the east base of the Charleston Mountains at an elevation a little below 4,000 feet. They were all taken under the prostrate limbs of decaying joshua trees. One other specimen was secured 10 miles east of Jean, Nevada, under the dead stump of a Spanish dagger (*Yucca mohavensis*).

Cnemidophorus sexlineatus perplexus BAIRD & GIRARD—One of the most abundant lizards on the floor of Zion Canyon, Utah, where 16 individuals were taken. In general, this species is more confined to the shaded portions of the canyon, gradually relinquishing, in a territorial sense, its terrestrial habitat to *C. t. tessellatus* at the mouth of the canyon.

Cnemidophorus tessellatus tessellatus (SAY)—This widely ranging lizard was taken at the following places:

Nevada: Boulder City	(6)	Mouth of Boulder Wash	(4)
Island No. 2	(4)	Mouth of Las Vegas Wash	(5)

Eumeces skiltonianus skiltonianus (BAIRD & GIRARD)—One skink belonging to this species was taken in the Charleston Mountains, Charleston Park, at an elevation of 7,500 feet.

SNAKES

Coluber flagellum frenatum (STEJNEGER)—Red racers were the only snakes seen abroad during the day. A juvenile was located entwined about a branch of a creosote bush at 10 P. M. one evening. Specimens from the following localities were taken:

Nevada: Mouth of Boulder Wash	(1)	8 mi. west of Boulder City	(1)
Boulder City	(2)	Black Canyon	(1)

Salvadora grahamiae hexalepis (COPE)—No specimens of the patch-nosed snake were taken. However, there was a specimen in

the collection of the Las Vegas High School, and Mr. A. E. Borell collected a specimen in the vicinity of the reservoir.

Phyllorhynchus decurtatus perkinsi KLAUBER — Two of these snakes were collected in the course of a drive from Las Vegas to Boulder City one evening. Both were found dead on the highway, freshly killed and in good condition. Despite the fact that the same drive was made on several evenings under similar conditions no other specimens were collected. It is of interest to note that, while in spring the majority of specimens taken are males, both of these taken on July 29th were females. The specific localities (previously published by Klauber) are 10, and 15 miles southeast of Las Vegas, Nevada.

Arizona elegans occidentalis BLANCHARD—A specimen, too badly smashed for preservation, although easily identifiable, was discovered on the road at Boulder City. No other specimens were seen although Mr. A. E. Borell secured four specimens of this snake in the Boulder Dam region in the course of his work in May.

Lampropeltis getulus californiae (BLAINVILLE)—One king snake of this species was taken by boys at Boulder City who discovered it near the stream from the sewage disposal plant. There were specimens in the collection at Las Vegas High School taken in the vicinity.

Sonora occipitalis (HALLOWELL)—Through the courtesy of Mr. Ben Ayres one of these small snakes found at Boulder City is in the collection at U.C.L.A. It was discovered beneath an incinerator in Mr. Ayres' yard. Although this species has not been previously recorded from Nevada, it is apparently not uncommonly observed in spring for there were several accounts of specimens which had been taken by boys (some of these may possibly have referred to the species following) who know it by the name of "pencil snake," an appelation presumably descriptive of its size.

Sonora semiannulata BAIRD & GIRARD—One specimen from the region has been available through the interest of Mr. Harold Coe of Boulder City who collected it about October 1, 1935 on the west slope of Fortification Mountain, Arizona (approximately three miles northeast of Boulder Dam). The specimen is barred similarly to those from the Grand Canyon but more brilliantly colored; the interspaces between the bars were bright orange-red in the live specimen. A skin of similar pattern and coloration was sent to the University of California at Los Angeles for identification in 1932, the snake having been uncovered in the course of blasting rock in the early stages of construction at Boulder Dam. This probably constitutes another Nevada record although it was not stated definitely on which side of the Colorado River the snake had been taken.

This species of *Sonora* apparently selects a rocky habitat in preference to burrowing in sand as does *S. occipitalis* and while the

two species occur in the same region, they probably occupy different ecological niches.

Hypsiglena ochrorhynchus COPE—One individual found dead on the highway in a rocky locality four miles west of Boulder City.

Trimorphodon vandenburghi KLAUBER—Considerable effort was expended prying off rocks in the foothills of the Charleston Mountains in a search for this snake which probably occurs there despite fruitless results. Through the generosity of Mr. L. M. Klauber we are able to include a Nevada record for this species, the specimen having been taken in the substation of the Southern Sierras Power Company located near Boulder Dam in Nevada.

Crotalus cerastes HALLOWELL—Four sidewinders were taken on Island No. 3, where their conspicuous and easily identifiable tracks were abundant in the sandy areas. One was located in the early morning a few inches inward from the entrance to a rodent (*Dipodomys*) burrow. A second specimen was taken on the wet sand along the water's edge where it had sought the shade of a depression in an overhanging bank. A third was discovered, securely hidden beneath a dense shrub in a similar location. The latter had devoured a full-grown *Dipso-saurus*. The tell-tale tracks of the sidewinder were found on several occasions in a sandy area at the mouth of Hemenway Wash, once connected by land with Island No. 3.

Crotalus mitchelli pyrrhus (COPE)—We are indebted to Mr. Harold Coe for sending us two rattlesnakes taken at Nelson, El Dorado Canyon, Nevada near the Colorado River below Boulder Dam. These specimens appeared to be typical of *pyrrhus*, but since *C. m. stephensi* has been taken approximately twenty-five miles north of Nelson in Las Vegas Wash they were sent to L. M. Klauber for verification. The record is of particular interest in that it constitutes a new northern record for the subspecies, and the first known occurrence of this form in Nevada.

Crotalus mitchellii stephensi KLAUBER—Two rattlesnakes belonging to this subspecies were taken at Harris Springs in the Charleston Mountains. This locality is on the southeastern slope of the range at an elevation of 6,000 feet in high Upper Sonoran Zone characterized by piñon and juniper.

Crotalus scutulatus KENNICOTT—Two specimens of this species were examined in the collection of Las Vegas High School. They had been taken in the immediate region.

TURTLES AND TORTOISES

Gopherus agassizii (COOPER)—Numerous individuals were available in Boulder City, most of them secured by children a mile or so south of the town. One small specimen taken at this locality has

been preserved. A shell and part of the skeleton of a tortoise was picked up at the mouth of Boulder Wash.

Trionychidae (family). A soft-shelled turtle belonging to this family was taken on hook and line at the lower portals of Boulder Dam on the Nevada side. Another specimen was seen on the bank of the reservoir just north of Black Canyon. Several specimens were taken by fishermen, both above and below Boulder Dam, and Mr. Murl Emery who has some fifteen years of experience on the Colorado River in the Nevada-Arizona region, advises that soft-shelled turtles have been seen at Pierce's Ferry, just below the lower end of Grand Canyon.

Some years ago (1929), the senior author secured a carapace of a soft-shelled turtle at California Lakes, Imperial County, California. Other specimens, now in the Museum of Vertebrate Zoology, were taken by Mr. Chester Lamb in the Colorado River below Yuma, Arizona, beyond the Mexican Boundary. The origin of these turtles is obscure, but there is some reason to believe that they have been introduced by the Chinese at Yuma.

For lack of adequate comparative material it has been impossible to date to ascertain with certainty the identity of this species of turtle, presumably a native of Asia. If the species is exotic as believed, it has become well established in the Colorado River and must occupy the stream in somewhat more than two hundred miles of its course.

SUMMARY

A total of forty-one species is recorded from the region under consideration. This includes seven amphibians, nineteen lizards, thirteen snakes, and two chelonians. The identity of certain toads previously recorded from the region is questioned, while a doubted record of *Scaphiopus hammondii* from Zion National Park has been verified. New records for the state of Nevada include: *Uta ornata symmetrica* (recorded from Nevada by Yarrow on the basis of a specimen of doubtful origin), *Sonora occipitalis*, *Trimorphodon vandenburghi*, *Crotalus mitchellii pyrrhus*, and a soft-shelled turtle, the specific identity of which has not been determined. This turtle is believed to be exotic, and when its identity becomes established it probably should be listed as a form established in Arizona, Nevada, California, and Lower California.

Caiman latirostris from the Pleistocene of Argentina, and a Summary of South American Cenozoic Crocodilia

by Bryan Patterson
Field Museum of Natural History

During 1934 a small collection of fossil vertebrates from eastern Salta was presented to the Field Museum by the Standard Oil Company of New Jersey, through the courtesy of Dr. Eugene Stebbinger. Most of the specimens were collected in the upper beds of the formation named Chaco by the Company's geologists, and are of Pleistocene age. With the exception of the one here described, they are fragmentary.

I am indebted to Mr. Elmer S. Riggs for the privilege of describing this specimen, and to Mr. Karl P. Schmidt for comparative material and valuable discussion. The drawings are by Mr. John J. Janecek. Dr. George Gaylord Simpson kindly loaned me his personal copy of Rusconi's paper on the Parana alligatorids (1933).

Caiman latirostris (Daudin)

For synonymy of the species see Schmidt 1928, pp. 216-217; the synonymy of the genus is discussed on p. 48.

Horizon: Upper Chaco beds, Pleistocene.

Locality: Quebrada Agua Blanca, eastern part of the Province of Salta, Argentina.

Collector: D. C. Herrell.

The fossil, F. M. No. P15029, was embedded in a hard sandstone concretion. It was found together with a glyptodont scute, fragments of *Toxodon* sp., part of the femur of a large ground sloth, and an upper molar of *Equus* sp. All were evidently derived from the upper Chaco (Herrell's field notes). The horse molar definitely indicates a Pleistocene age for the assemblage.

The caiman specimen consists of a well preserved snout from a large old individual, slightly weathered on the left side and at the anterior extremity. The snout is short and broad. The prominent U shaped preorbital ridges and the lower nasal ridges agree exactly with those of *C. latirostris*. The external narial aperture and the arrangement and proportions of the teeth are also similar. The following differences from two recent skulls of *latirostris* available for comparison have been noted. In the fossil the palatines are widest opposite the anterior ends of the palatine fenestrae and then taper rapidly forwards, the truncate anterior extremity being quite narrow. The premaxillary-maxillary suture on the palate is not transverse in direction but is acute anteriorly. The pits between the inner margins of the alveoli on the premaxillaries and maxillaries are much larger and deeper in the fossil. These minor differences, as well as the larger size, appear to be within the limits of individual and age variations. Apart from them, the description of *latirostris* given by Mook (1921. b, pp. 228-232) is entirely applicable to the

present specimen. For good figures of a recent skull of the species, see Schmidt (1928, pls. 16-17). As stated above, the anterior end of the snout is weathered. This weathering has removed the roofing, if originally present, of the pits for the first mandibular teeth. It is impossible to be certain of the original absence of these perforations, but even if they are natural their presence does not necessarily affect the reference of the specimen to *latirostris*. Piercing of the premaxillaries by the anterior mandibular teeth is a normal character in *Caiman jacare* and other species but has not been reported in *latirostris*, although specimens that show it may well be expected.

One feature of the fossil might serve to separate it from *latirostris*. The snout is somewhat longer (13%) than wide, measuring from the center of the antorbital ridge (see table of measurements below). In the recent material available the breadth from this point is either less (3%), equal to, or but very slightly greater (3%) than the length. This series—two alcoholic specimens and two skulls—is, however, insufficient for conclusions as to the extent of individual variation in the breadth-length proportions of the snout of *latirostris*. * The Salta fossil must be referred to this species, at least for the present. If much more recent material than is now available in museums should show in the future that the breadth of the snout is in all cases practically as broad as long, it may become necessary to refer the specimen under consideration to a distinct species. It is conceivable that some reduction in the length of the snout has occurred since the Pleistocene in the *latirostris* group. It is more likely, however, that the characteristic brachycephaly was acquired much earlier, for *C. paranensis* (Scalabrini) from the lower Pliocene has as broad a snout as the recent specimens of *latirostris*.

The fossil was found some 250 miles west of the present range of *latirostris*.

Measurements in mm.	P15029	9713	11009
Breadth of snout at fourth tooth	117	83	74
Breadth of snout at ninth tooth	167	145	112
Breadth of snout at antorbital ridge	193	172	143
Length of snout from antorbital ridge	218	166	147
Percentage of length to breadth of snout (breadth = 100)	113%	97%	103%

In preparing the brief description given above, I have consulted most of the literature dealing with South American fossil crocodiles. Much of this is so scattered that several authors seem to have been unaware of important parts of it. It appears therefore that a summary of the known fossil forms together with the references would be of some value. This is given below.

Two localities have yielded the greater part of the known material; the Parana region in Argentina, and the upper Rio Purus region in the southwestern part of Amazonas Province, Brazil. The latter area has apparently never been investigated by a paleonto-

* A specimen figured by Siebenrock also has a snout broader than long.

PLATE IV

CAIMAN LATIROSTRIS FROM THE PLEISTOCENE OF ARGENTINA

logist, all the specimens from it having been obtained either by travelers, traders, or by specialists in other fields of science. The Parana material has been redescribed recently by Rusconi (1933 and 1935) who recognizes five genera and seven species, one of them with a sub-species. This seems to be too large an assemblage for one area, and some of the forms recognized by him are placed in synonymy here. Crocodiles are as a rule mutually exclusive in their ranges, the largest recent association being the presence of four species in the Amazon basin.

With the exception of the Eocene *Eocaiman*, no Tertiary species have been found in deposits earlier than the Entrerrios beds at Parana here regarded as lower Pliocene.

Alligatoridae

Eocaiman cavernensis Simpson

Eocaiman cavernensis Simpson, 1933, Amer. Mus. Novit., No. 623: 1-9, fig. 1-2; Rusconi, 1933 Rev. Univ. Nac. Cordoba, **20**: ⅛, p. 50.

Horizon: Casamayor (*Notostylops*) beds, middle or upper Eocene.

Locality: Barranca south of Lake Colhue-Huapi, Chubut, Argentina.

Remarks: Known from the anterior portions of an associated skull and jaws. This species is the best known and probably the most important yet discovered in the South American Tertiary. As stated by its author, it appears to be near the ancestry of both *Paleosuchus* (= *Caiman* auct., see p. 49) and *Caiman* (= *Jacare* and *Jacaretinga* auct.), thereby indicating that the caimans are indigenous to South America. This confirms Dunn's earlier belief (1931, p. 114) that they are "old South American" forms. The relationships of *Eocaiman* with *Allognathosuchus* and other early Tertiary North American alligatorids points to a northern origin of the caiman group. This adds appreciably to other evidence favoring a northern origin for the indigenous neotropical Tertiary fauna, in accordance with the Matthewsian view of dispersal.

Proalligator australis (Burmeister)

Crocodilus australis Bravard, 1858, Monografia de los terrenos terciarios de las cercanas del Parana, Buenos Aires, (reprinted in An. Mus. Publico Buenos Aires, p. 45-94, See p. 66) — nomen nudum; Burmeister, 1885, An. Mus. Publico Buenos Aires, 3: 148-150.

Proalligator australis Ambrosetti, 1890. Bol. Acad. Nac. Cienc. Cordoba, 10: 420-421, 423-426—part; Rusconi, 1932, El Libro de la Cruz Roja Argentina, Buenos Aires, p. 197;* 1933, Rev. Univ. Nac. Cordoba, 20: ⅛, p. 5-13, fig. 1, 2a. 10.

Alligator australis Rovereto, 1912, An. Mus. Nac. Buenos Aires, (3), 15: 341-346, fig. 1-2, pl. 16, fig. 1, 7—part.

Jacaretinga australis Saez, 1928, An. Soc. Cient. Arg. 106: 67-71, fig. 1-3—part.

Crocodilus meridionalis Scalabrini, 1887, Cartas Cientificus, Parana, p. 37.*

Aligator paranensis Scalabrini, 1887, Cartas Cientificas, Parana, p. 37, *nomen nudum*

* Not available, references fide Rusconi (1933). Paranasaurus Scalabrini is a nomen nudum according to this author.

Horizon: Entrerrios beds, * lower Pliocene.

Locality: Vicinity of Parana, Argentina.

Remarks: Known from upper and lower jaw fragments and dermal scutes. It is very insufficiently known, but appears to be distinguished from *Caiman* and *Paleosuchus* by the teeth which are less differentiated in size.

Dinosuchus terror Gervais

Dinosuchus terror Gervais, 1876, Journ. Zool. 5: 232-236, pl. 9.
Brachygnathosuchus braziliensis Mook, 1921. Bull. Amer. Mus. Nat. Hist., 44: 43-49, fig. 1-4; Rusconi, 1931, La Semana Medica Buenos Aires, **38**: 531-533, fig; 1933, Rev. Univ. Nac. Cordoba, **20**: ⅞, p. 44-45.

Horizon: ? Pliocene. Mook's material was associated with a tooth of ? *Eumegamys* sp. and a humerus of a megalonychine sloth. As Rusconi has pointed out (1933, p. 45), these remains may indicate a possible agreement in age between the Purus and Parana deposits. This is of some interest in connection with the possible identity of large caimans occurring at both localities (see below).

Localities: "Amazonas", Brazil (Gervais); upper Rio Purus region, southwestern part of Amazonas, Brazil (Mook); Acre Territory, Bolivia (Rusconi).

Remarks: The holotype specimen is an incomplete vertebra. Mook's specimen consists of the anterior portion of the dentary, two centra, and an eroded dermal scute. Rusconi's record is based on a tooth.

Mook in his paper did not refer to Gervais' work. Nopcsa (1924), from comparison of the figures given by these authors, came to the conclusion that *Brachygnathosuchus* is a synonym of *Dinosuchus* and in this I follow him, at least until more material is forthcoming. Nopcsa further considered that *Purussaurus* Rodrigues from its similarity to *Brachygnathosuchus* should also be placed in the synonymy of *Dinosuchus*. With this disposition I am quite unable to agree (see below).

D. terror is a very large species readily distinguishable from any *Caiman* by the great depth of the anterior part of the dentary and the shortness of the symphysis.

Caiman Spix

The majority of authors employ the incorrect names *Jacare* or *Jacaretinga* for the genus *Caiman*. Spix proposed *Jacaretinga* and *Caiman* in 1825 and included in the latter the species *niger* and *fissipes* (=*latirostris*).

These generic names were not employed by any other author

* It has long been suspected that the Parana fossils came from two horrizons. These have been named Paranense and Mesopotamiense by Argentinian authors, although it is not yet known what fossils are characteristic of either. The term Entrerrios beds is used here as an inclusive name.

until 1844, when Gray, that "zoological whirlwind" as Huxley so aptly called him, recognized *Caiman* but misapplied the name by referring the species *trigonatus* and *palpebrosus* to it. For *niger* and *sclerops* he proposed the unnecessary name *Jacare*. The existing confusion dates back to this initial error of Gray's. In 1889 Boulenger united the smooth fronted and spectacled caimans in the genus *Caiman*, thus including under this name the orginal species placed in *Caiman* by Spix. Vaillant (1893) was the first author to re-employ *Jacaretinga* Spix, believing that it should replace *Caiman* on the grounds of page priority. However, Boulenger's use of *Caiman* in 1889 is regarded as constituting a clear preference for this name over *Jacaretinga*. This in brief is Schmidt's (1928) argument, and his case seems sound. He selected *C. fissipes* Spix (=*latirostris* Daudin) as the genotype. For the species included in *Caiman* Gray (not of Spix) by most authors, the name *Paleosuchus* Gray 1862 is employed by Schmidt. Werner's (1933) transfer of *Crocodylus* to these forms has fortunately been set aside by Stejneger (1933).

Purussaurus and *Xenosuchus*, regarded here as synonyms of *Caiman*, are discussed below under the species referred to them by their authors.

Caiman brasiliensis (Rodrigues)

Purussaurus brasiliensis Rodrigues, 1892, Vellosia, **2**: 50-52, pl. 16, fig. 1-3.

Horizon: ? Pliocene. *

Locality: Rio Purus region, southwestern part of Amazonas, Brazil.

Remarks: Known from the anterior half of a right dentary 570 mm. long. This enormous fragment indicates an animal that must have exceeded thirty feet in length. The type of *brasiliensis* is greatly obscured by concretionary matrix and, judging from the photographic reproductions, considerably weathered. I can find nothing in Rodrigues' description to warrant separation from *Caiman*, since I am not prepared to accept mere size as a generic distinction. It is entirely possible, however, that more complete material might validate the genus. The first alveolus is stated by Rodrigues to be extremely large but this seems to have been broken in the specimen. The described differences in the symphysis appear also to be due, at least in part, to weathering.

Nopcsa (1924) considered *Brachygnathosuchus* as a synonym of *Purrusaurus* (sic) and this form in turn as a synonym of *Dinosuchus*. Mook (1934, pp. 302-303) regarded *Brachygnathosuchus* as valid and an alligatorid, but made *Purrusaurus* (sic) a synonym of *Dinosuchus* which he placed in the Crocodylidae. As stated above, I can see no present alternative to following Nopcsa in relegating *Brachygnathosuchus* to the synonymy of *Dinosuchus*. Granting this, it is

* Judging from the scanty material associated with Mook's specimen of Dinosuchus. It is possible, of course, that all the Rio Purus material may not have come from the same horizon.

certain that *Dinosuchus* can not be referred to the Crocodylidae. "*Purussaurus*" seems to be distinguished from "*Brachygnathosuchus*" by its longer and much shallower symphysis. * It may be noted that on pl. 16 of Rodrigues' paper figs. 2 and 3 obviously represent the ventral and internal views of the specimen, not the internal and ventral as the caption states. This may have misled Nopcsa, who very evidently gave the matter only the most cursory consideration, as to the depth of the symphysis. Since there are no comparable parts of "*Purussaurus*" and *Dinosuchus*, Mook's action (1934) in relegating the former to the synonymy of the latter, while retaining *Brachygnathosuchus* as distinct is not followed here.

Rusconi having noted the fact that the Rio Purus and the Parana deposits may be contemporaneous, the possibility remains that *C. brasiliensis* may be a synonym of *C. paranensis* (Scalabrini). The latter appears to differ from *brasiliensis* in its rather longer symphysis but this distincton may possibly be due to breakage in the holotype of the Rio Purus species. *C. brasiliensis* is much larger than *C. paranensis* but this may indicate no more than an age difference. For the present it seems preferable to retain *C. brasiliensis* as a distinct species, pending the collecting of further material from both localities and a more complete understanding of the age of the Rio Purus horizon or horizons.

In addition to *Purussaurus*, Rodrigues described two other species of reptiles: *Emys quaternaria*, based on what he regards as parts of the pelvis, and *Colossoemys macrococcygeana*, based on vertebrae and supposed iliac and plastral fragments. The very large vertebrae of the latter were regarded as crocodilian by Nopcsa who proposed the name *Emysuchus* for them. This author evidently consulted only the plates of Rodrigues' paper, on which the material is labeled *Emys macrococcygeana*. It is evident from his paper that he did not read the description and thus completely overlooked the fact that Rodrigues had applied the name of *Colossoemys* to these vertebrae! Mook (1934) follows him in this error. Any present attempt to straighten out this confused situation would be useless. Rodrigues' descriptions and figures of *Colossoemys*, as well as of *Emys quaternaria*, are so unsatisfactory and the specimens so fragmentary and poorly preserved, that these species should be regarded as incertae sedis. Dr. B. L. Dahlgren has informed me that the institution in which the specimens were deposited, the Museo Botanico do Amazonas, went out of existence more than forty years ago. It is very possible therefore that the types have been lost.

Caiman paranensis (Scalabrini)

Crocodilus paranensis Scalabrini, 1887, Cartas Cientificas, p. 37.
Proalligator paranensis Rusconi, 1932, El Libro de la Cruz Roja Argentina, Buenos Aires, p. 197.

* Provided that Mook's specimen of D. terror is not pathologic, a possibility that does not seem to have been considered by any author.

Xenosuchus paranensis Rusconi, 1933, Rev. Univ. Nac. Cordoba, 20: ⅓, p. 13-24, fig. 3-6a, 7, 9.

Proalligator australis Ambrosetti, 1890, p. 422-423—part.

Alligator australis Rovereto, 1912, An. Mus. Nac. Buenos Aires (3), 15: 340—part.

Jacaretinga australis Saez, 1928, An. Soc. Cient. Arg. 106: 71-72—part.

Alligator? ameghinoi Rovereto, 1912, An. Mus. Nac. Buenos Aires, (3), 15: 360-366 fig. 13B-17.

Xenosuchus paranensis ameghinoi Rusconi, 1933. Rev. Univ. Nac. Cordoba, 20: ⅓, p. 24-26, fig. 8.

Alligator lutescens Rovereto, 1912, An. Mus. Nac. Buenos Aires, (3), 15: 346-360, fig. 3, 4B, 5, 8-12, pls. 16, fig. 2-6; 17, fig. 3-4; 18, fig. 1-16.

Xenosuchus lutescens Rusconi, 1933, Rev. Univ. Nac. Cordoba, 20: ⅓, p. 26-37, fig. 11B-14.

Horizon: Entrerrios beds, lower Pliocene.

Locality: Vicinity of Parana, Argentina.

Remarks: Known from skull and jaw fragments, isolated vertebrae and limb bones.

I am unable to follow Dr. Rusconi in referring this species to a distinct genus. The characters of *Xenosuchus* that he gives (1933, p. 13) are as follows: (1) nearly twice as large as *Caiman* and *Proalligator;* (2) mandible heavy and robust; (3) anterior teeth proportionately and absolutely larger than those of *Caiman;* (4) premaxillary with five well developed teeth; (5) third and fourth upper alveoli regularly measure between 30 and 40 mm. in diameter.

Specimens of *paranensis* probably exceeded a length of 20 feet in life. Although this is greatly in excess of the length attained by most living caimans, individuals of *C. niger* probably come close to eighteen feet (Schmidt, personal communication). Furthermore, size does not appear to be a very reliable character in reptiles. (2) appears to be a corollary of (1). In proportion to the length of the tooth row, the anterior teeth of *paranensis* are two to three percent larger than those of specimens of *C. latirostris* and *C. yacare.* This may be regarded as a specific character but hardly as a generic one. (5) is a corollary of (3). Were *Xenosuchus* to be recognized on the basis of (1) and (3), it would appear necessary to recognize *Purussaurus* also. If this were done the former might well be regarded as a synonym of the latter. Until more material is obtained I prefer to follow a conservative course and refer both *paranensis* and *brasiliensis* to *Caiman.*

The species *ameghinoi* and *lutescens* of Rovereto are relegated to synonymy here. The former is but little smaller than *paranensis* and it seems very unlikely that there would be two very large species of the same genus inhabiting the same area. *Lutescens* was based on smaller specimens, but since the descriptions reveal no morphologic differences I regard the material as representing younger individuals of *paranensis.* The holotype of *lutescens* consists of a premaxillary and maxillary which agree with *latirostris* in that the breadth of the snout at the anterior border of the orbits is greater than the length from this line (Rovereto, 1912, pl. 16, fig. 2; text-fig. 4).

Caiman praecursor (Rusconi)

Jacaretinga praecursor Rusconi, 1933, Rev. Univ. Nac. Cordoba, 20: ¾, p. 37-39, fig. 15.

Horizon: Entrerrios beds, lower Pliocene.

Locality: Vicinity of Parana, Argentina.

Remarks: Known from the anterior third of a right mandible. Size comparable to that of large individuals of *C. yacare*, the Paraguay caiman. Distinguished by the participation of the splenial in the symphysis.

Caiman latirostris (Daudin)

Caiman latirostris, this paper.

Horizon: Pleistocene.

Locality: Eastern part of Salta, Argentina.

Remarks: Schmidt (1928, p. 228) has observed that *Caiman sclerops*, *C. yacare*, and *C. fuscus* constitute a formenkreis, a fact which would indicate that the small, narrow snouted caimans are, or were recently in the geological sense, an expanding group. The holotype of "*lutescens*" and the Pleistocene specimen referred to *latirostris* in this paper suggest on the other hand that there may have been an earlier radiation of broad snouted caimans, some of them extremely large, of which *latirostris* is now the sole survivor.

Caiman sp.

Alligator sp. Lydekker, 1888, Cat. Foss. Rept. Amphib. Brit. Mus. 1, p. 45.

Horizon: Cave deposits, Pleistocene.

Locality: Minas Geraes, Brazil.

Remarks: Known from a single caudal vertebra which "probably belongs to one of the existing Brazilian species . . . "

Crocodylidae

Gryposuchus jessei Gürich

Gryposuchus jessei Gürich, 1912, Mitt. Min. Geol. Inst. Hamburg, (4 Beiheft, Jahrb. Hamburg, Wiss. Anst., 29: 1911) p. 59-71, pl. 1, fig. 1; pl. 2; Müller, 1927, Abh. Bayer, Akad, Wiss., (Math. Nat.), 31: 2 Abh., p. 85.

Horizon: ? Pliocene.

Locality: Rio Pauynim (a tributary of the Rio Purus), southwestern part of Amazonas, Brazil.

Remarks: Known from a well preserved portion of the rostrum. A long snouted form comparable to *Tomistoma*.

Leptorramphus entrerrianus Ambrosetti

Leptorramphus entrerrianus Ambrosetti, 1890, Bol. Acad. Nac. Cienc. Cordoba, 10, p. 417-418; Rusconi, 1935 An. Soc. Cient. Arg. 119: 211.

Horizon: Entrerrios beds, lower Pliocene.

Locality: Vicinity of Parana, Argentina.

Remarks: Known from the "antero-superior part of the rostrum". A small moderately long snouted form, considered by its author to be a gavialid. This identification seems incorrect, for the piece, 135 mm. long, decreases in width from 80 mm. at the posterior extremity to 30 mm. anteriorly. The genus was placed by Mook (1934, p. 303) in the Crocodylidae. A very unsatisfactorily known form.

Crocodylus sp.

Crocodilus sp Swinton, 1928, Quart, Journ. Geol. Soc. 84:583.

Horizon: Middle or upper Pliocene.

Locality: About 38 miles east of Maracaibo, Venezuela.

Remarks: Known from a dorsal vertebra.

Crocodylus sp.

? *Crocodilus* Maury, 1925, Monog. Serv. Geol. Min. Brasil, 4: 438.

Horizon: "Purple and lavender shales characterized by "*Anomia macedoi* Maury". "Miocene-Pliocene".

Locality: Pirapemas on Rio Itapicuru, Maranhao, Brazil.

Remarks: Known from a single tooth.

Rhamphostomopsis neogaeus (Burmeister)

Rhamphostoma neogaea Burmeister, 1885, An. Mus. Publico Buenes Aires, 3: 151-152; Ambrosetti, 1890, Bol. Acad. Nac. Cienc. Cordoba, 10: 414-417.

Garialis neogaeus Rovereto, 1912, An. Mus. Nac. Buenos Aires, (3), 15: 367-368, fig. 18, pl. 18, fig. 17-19.

Rhamphostomopsis neogaeus Rusconi, 1933, Rev. Univ. Nac. Cordoba, 20: ⅓, p. 50; 1935, An. Soc. Cient. Arg., 119: 205-209, fig. 1, 2a.

Rhamphostomopsis intermedius Rusconi, 1933, Rev. Univ. Nac. Cordoba, 20: ⅓, p. 50; 1935, An. Soc. Cient. Arg. 119: 209-211, fig. 3.

Horizon: Entrerrios beds, lower Pliocene.

Locality: Vicinity of Parana, Argentina.

Remarks: Known from portions of the rostrum and symphysis, and isolated teeth. A larger species than *Gavialis gangeticus*. As Rusconi has observed, the genus is not well characterized at present, but it is almost certain to be fully validated when more complete material is available. The smaller rostral fragment made by Rosconi the type of *intermedius* was earlier identified as *neogaeus* by Rovereto. I follow the latter and regard the specimen as being from a young individual of *neogaeus*.

Rusconi (1935, p. 211) has taken the sound step of rejecting as indeterminate the genus and species *Oxysdonsaurus striatus* Ambrosetti, based on a single tooth.

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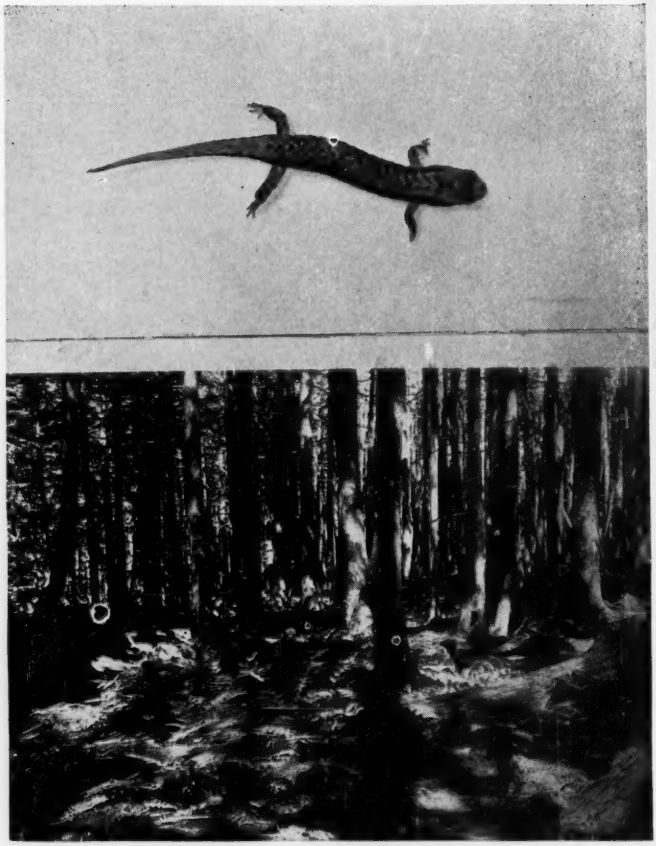
ADDENDUM

At the time of writing, Smith Woodward's determination of the age of the Parana as lower Pliocene was accepted. Recently, Leriche's very valuable paper on the importance of fossil sharks in inter-continental correlation has been received (Mem. Mus. Roy. Hist. Nat. Belgique, (2), fasc. 3, pp. 739-773, 10 maps). Among the fossil fishes of Parana is *Hemipristis serra*, a species not found elsewhere outside of the Miocene. From this occurrence, Leriche believes (p. 749) that the age of the beds should be considered as upper Miocene.

PLATE V



DESMOGNATHUS WRIGHTI, sp. nov.

Above: Adult male collected at Clingmans Dome, June 17, 1936. Photograph by Jim Thompson

Below: Forest on Mt. LeConte; the habitat of the species.

A New Salamander (Desmognathus) from the Southern Appalachians

by Willis King
Wild Life Technician, Great Smoky Mountains National Park

DESMOGNATHUS WRIGHTI* sp. nov.

Type U. S. National Museum, No. 101794, male, from Mount Le Conte, Sevier County, Tennessee, Great Smoky Mountains National Park collected by Willis King.

Paratypes—U. S. N. M. 101790-802, Mt. Le Conte; U. S. N. M. 10183-4, Pecks Corner; U. S. N. M. 10185-6, Mt. Hardison; U. S. N. M. 101807-13, Brushy Lead; U. S. N. M. 101813-14, White Rock, all collected by the author; and Cincinnati Society of Natural History, 789 (26 specimens), Newfound Gap, collected by H. Weller and R. Dury.

Range—Known from the spruce-fir forests of the Great Smokies from Clingman's Dome to White Rock, from Mount Sterling and Flat Creek; from Grandfather Mountain, North Carolina; and from Looking Glass Creek, Transylvania County, North Carolina.

Diagnosis—A small *Desmognathus* with vomerine teeth in adult life; tail not keeled above, terete; belly light; rarely exceeding 50 mm. in total length; body length approximately equal to or greater than tail length; terrestrial, inhabiting certain high humid forests of the Southern Appalachians.

Description of Type—Adult male; with 14 costal grooves and 3 costal folds between appressed toes; head width 6.75 in length from snout to vent; head length 3.2 in length of body; head oval, snout slightly truncate; diameter of eye less than its distance from tip of snout; outline of upper jaw only slightly sinuous; angle of jaw back of hind angle of eye; limbs well developed; fingers 3,2,4,1 in order of length; toes 3,4,2,5,1 in order of length; vent papillate; tail tapering to a fine point, terete; vomerine teeth 6-6; parasphenoids joining anteriorly, separate posteriorly, beginning at middle of orbit; premaxillary teeth enlarged; mandibular teeth extending one-half to two-thirds of the distance to angle of jaw; back and top of head light brown, with dark brown pigment in the intervertebral grooves and in the upper portions of the costal folds, forming a series of inverted V's; a dark line along each side, fairly definite above, becom-

*The name *wrighti* was chosen in honor of George M. Wright, former Chief of the Wildlife Division, National Park Service, whose untimely death at Deming, New Mexico, February 25, 1936, brought an end to a career which held so much of friendship and professional promise. His deep concern for American wildlife, together with his unusual ability to accomplish his ends, made him respected by all with whom he dealt. His loss is greatly to be lamented.

ing lighter beneath, and extending from the side of the snout to half the length of the tail; a light line from the eye to the angle of the jaw; total length 46 mm., head 6.5, body 20.5, tail 19 mm.

Table No. 1 Measurements of twelve individuals of *Desmognathus wrighti*

Locality	Collection	Sex	Length	Head	Body	Tail	V.T.	C.F.
Transylvania Co., N. C. Looking Glass Creek	U. S. N. M. 61305	♂	44	6	20	18	3-3 ?	3
G. S. M. N. P. Newfound Gap	C. S. N. H. 789	♀	40	6	18	16	6-4	3
G. S. M. N. P. Newfound Gap	C. S. N. H. 789	♀	40	6	18	16	4-5	3
G. S. M. N. P. Newfound Gap	C. S. N. H. 789	♂	41	6	17.5	17.5	4-4	4
G. S. M. N. P. Newfound Gap	C. S. N. H. 789	♂	43	7	19	17	5-7	3
G. S. M. N. P. Newfound Gap	C. S. N. H. 789	♂	43	6.5	18.5	18	5-5	3
G. S. M. N. P. Newfound Gap	C. S. N. H. 789	♂	37	6	15	16	4-4	3
G. S. M. N. P. Mt. LeConte	U. S. N. M. 101790	♂	49	7.5	19.5	22	4-3 ?	3
G. S. M. N. P. Mt. LeConte	U. S. N. M. 101792	♂	46	7	19	20	5-5	3
G. S. M. N. P. Mt. LeConte	U. S. N. M. 101798	♂	42	6	18	18	5-6	3
G. S. M. N. P. Mt. LeConte	U. S. N. M. 101791	♀	42	6	19	17	5-5	3
White Rock	U. S. N. M. 101813	♀	48	6	21	21	2-5	3

Abbreviations: U.S.N.M.—United States National Museum
G.S.M.N.P.—Great Smoky Mountains National Park
C.S.N.H.—Cincinnati Society of Natural History
V.T.—Vomerine teeth
C.F.—Costal folds between appressed toes

Variation—Females differ in having the vent smooth, premaxillary teeth somewhat smaller, snout less truncate and more rounded, and slightly shorter tail in proportion to body length. The vomerine teeth on 30 specimens average 4.6 on each side. Occasionally as many as 8 were counted on one side, and as few as 2. No animals were found which lacked teeth on both sides. The number of costal grooves is 14, while the number of costal folds between the appressed toes is usually 3, rarely 2 or 4. A table giving the measurements of several individuals is included.

General Comments—This species is readily distinguished from *D. fuscus carolinensis* by its striking color pattern, its uniformly small adult size and by its less active behavior. It never shows the rounded dots which typify immature *D. f. carolinensis*. Sometimes the lateral margins of these circular areas are visible but they never invade the dorsal band, which may vary from yellow to brick red, but which is usually light brown. A small percentage of the specimens examined are plain, not showing the pattern of V's. The new

form has a much more limited range than does *D. f. carolinensis*, both as to altitude and forest type. In the Great Smokies the latter ranges widely above 2500 ft. elvation, while the former is rarely found below 5000 feet. The small species may be mature by the time it reaches a length of 35 mm., while *D. f. carolinensis* is definitely immature below 50 mm. My largest specimen of the new form, an adult male, is 49 mm. in total length.

Superficially the species resembles *D. f. ochrophaeus* in having a light belly, a fairly plain dorsal band, and in its terrestrial habits, but differs clearly in its uniformly small size and persistance of the vomerine teeth in the male. It differs both from *D. f. carolinensis* and *ochrophaeus* in proportion in that its body averages slightly more in length than the tail, while in both the other forms, the tail at least equals the body in length in young of a comparable size and exceeds the body in adult specimens. A definite pigment pattern is indicated on the region of the head from the eyes to the snout. A median light band is enclosed by two darker bands. These are each bordered laterally by an additional light band, which in turn is supported by a heavily pigmented area.

The preferred habitat is under small logs and stones in the spruce-fir forest, in places only moderately moist. It was not taken under large logs or stones that were deeply buried in soil. Adults may be found throughout the summer and early fall, and enlarged eggs are found in the oviducts of the female in September. Two females of 45 mm. total length taken September 23, 1934, contained 13 and 14 eggs respectively. Neither eggs nor larvae have been collected in the field.

A comparative study of this and other forms leads me to believe it a full species, which probably arose as a dwarf mutation from the *carolinensis-ochrophaeus* stock. Intergrades with these sub-species of *fuscus* have not been found. Superficially it resembles *D. f. ochrophaeus* most, but is not known to enter the latter's range. A wider study of distribution with data on breeding habits is necessary to determine the exact position which this species occupies in the genus *Desmognathus*. Confusing elements exist in such anatomical characters as persistence of vomerine teeth in the male; simple dorsal pigmentation, which however may be secondary; and its thoroughly terrestrial habit.

Noble (1927) states that "In *Desmognathus*, the smallest species have the most pronounced sexual dimorphism". The present case bears this out as secondary sex characters are very definite in the male. Papillate vent, enlarged teeth on the maxilla and especially the premaxilla, more truncate snout and slightly longer tail illustrate the point. In the same paper Noble states, "In the evolution of the genus *Desmognathus* from the large *D. quadra-maculatus* to the small *D. fuscus ochrophaeus*, the male exhibits a greater and greater tendency to lose its vomerine teeth and to reduce the anterior part of the parasphenoid teeth patches". While the present small form is

undoubtedly related to *ochrophaeus*, it fails to bear out this generalization in that it not only has the anterior part of the parasphenoids well developed, but the vomerine teeth as well.

Approximately 100 specimens of the species have been examined carefully, three-fourths of them were seen in the field. At least fifty additional individuals were seen but not collected, as overcollecting might reduce the species to a dangerous point.

It has also been taken by Mr. Raymond Fleetwood, former Wildlife Technician, at Mount Sterling (Ridge). A collection of *Desmognathus fuscus ochrophaeus* from the U. S. National Museum, kindly loaned to me by Dr. Doris Cochran, contained one specimen of the new form (No. 61305), collected at Looking Glass Creek, Transylvania County, North Carolina, by J. E. Benedict, Jr. in 1907. Mr. Ralph Dury of the Cincinnati Society of Natural History was kind enough to loan 26 specimens collected by himself and W. H. Weller near Newfound Gap in the Great Smokies September 1, 1930. These workers considered the form new at the time, but later accepted the belief that it was a local juvenile form of *D. f. carolinensis*.. Weller (1931), describes the form closely and states: "It was found abundant only under the tightly fitting bark of stumps or standing trees at high elevations". Weller's description is unmistakable as are his specimens. In this paper, however, he places this zigzag form, as he describes it, under *D. f. carolinensis*. He also reports finding this salamander at Grandfather Mountain, North Carolina.

Acknowledgments are due Dr. Doris Cochran for the loan of specimens of *D. f. ochrophaeus* and permission to study the collections in the U. S. National Musuem; to Mr. Ralph Dury both for the loan of specimens collected by him and the late W. H. Weller, and for permission to use the late Mr. Weller's notes; and Dr. E. R. Dunn for examining some of the first specimens taken by me. It was the inspiration of Dr. Dunn, my former Professor, which led my search for a new species of salamender.

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The Re-discovery of Anolis gadovii

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Boulenger, in 1905, described *Anolis gadovii* from one male specimen collected by Gadow at Tierra Colorado, Guerrero. No other specimens have been recorded since, excepting one referred to this species by Smith (1933). His detailed description of the specimen made it quite apparent that his *Anolis* differed widely from the type of *A. gadovii* in a number of salient features; it is not surprising, therefore, that Smith recently (1936) re-described his specimen as a new species, *A. dunni*.

In view of the facts that nothing was known heretofore about the habits of *Anolis gadovii*, that it was known from the type only, and the female was unknown, and that some remarks of Smith's (1936) are rather misleading, it seems desirable to report on a collection of 14 topotypes obtained by the writer at Tierra Colorado in 1935.

Anolis gadovii is quite common near Tierra Colorado, but sharply restricted to a specific and peculiar habitat. All specimens were found on large boulders, where the very dark-colored males and inconspicuous grey females were clinging to vertical and even overhanging, shady rock faces. Their somber, reticulated coloration blends so perfectly with the somewhat rough surface of the rock that it is often difficult to detect a specimen even though one may be looking straight at it. The males betray their presence by suddenly unfolding their very large, gorgeously purple colored throatfans, as fascinating a sight as any herpetologist could wish to see.

The agility of this rather singular lizard on the precipitous terrain which it inhabits is remarkable, and reminds one of *Uta mearnsi* which frequents a very similar habitat in California and Lower California. One series of *gadovii* was collected on the tumbled boulders of a narrow stream bed in the forest quite close to the village, another series in a boulder-strewn area on a forested mountain slope a few miles above Tierra Colorada along the auto road. The saxicolous *gadovii* differs sharply in habitat selection from *Anolis nebuloides* which is very common in the vicinity of Tierra Colorada, and frequents trees and fences, especially along the river, and on relatively level stretches in the valley.

Tierra Colorada, whence the type of *A. gadovii*, and my fourteen topotypes came, is located 50 miles from the coast of Guerrero, north of Acapulco, at 1,000 feet elevation in a rather narrow river valley which is bounded by high, forested mountain ridges. Thus it is rather mystifying why Smith points out that the ecological niche of *gadovii* is represented by the "coastal plain."

Smith has recently seen one of my specimens, and I have had the privilege of examining his type of *A. dunni*. Since he states in his diagnosis of the latter, "Resembling *Anolis gadovii* BOULENGER,

in most characters," it seems advisable to add a few differential characteristics of the actual *gadovii*. In my opinion there is little, if any, superficial resemblance between the two forms.

The adult male specimens in my collection agree well with Boulenger's original description. The large scales of the supraorbital semi-circles are broadly in contact with each other in the mid-line; laterally, they are separated from the three enlarged supraoculars by two rows of small scales in eight specimens, by two rows on one side, and three rows on the other side in three specimens, by two rows of small scales and one row of slightly enlarged scales in one specimen, and by only one row of small scales in another specimen. The occipital is separated from the supraorbitals by two rows of small scales in all specimens; in three of them a few scales, suggesting a third row, are intercalated. The scales of the occipital and temporal regions and of the dorsal surface of the body are very small and granular, relatively very much smaller than those of *dunni*. One or two rows of barely enlarged, granular scales are found along the mid-dorsal line, while *dunni* possesses a fairly wide mid-dorsal band of distinctly enlarged scales.

The dorsal ground color of the male is a somber, brownish grey, somewhat lighter on the head, especially in the temporal region, on the extremities, and on the tail. The pattern consists of black reticulations which are made up of the following principal elements: 2-3 irregular, wavy or broken black lines, closely paralleling along the flanks, and a series of black chevron lines, open forward along the back, most clearly defined in the posterior thoracic and lumbar regions. The very large dewlap is of a brilliant purple, with rows of violet-colored scales. In the table of measurements I have recorded the length of the longitudinal attachment of the dewlap from throat to thorax.

The female is somewhat smaller and lighter in color than the male, with indistinct dark markings, of which the mid-dorsal chevron bands are best defined. The ventral surface is greyish or a dirty-yellow; a small mid-ventral gular fold extends from a point between the angles of the mandible to the anterior thoracic region, surrounded by a lozenge-shaped area of enlarged scales which correspond to the dewlap of the male; the enlarged scales are bluish, the intervening skin reddish. All females show on the anterior gular scales a light spot in the shape of a V, open forward, followed by a median light spot.

Table of measurements in mm. of the largest male and female specimens:

Sex	Snout to Vent	Snout to Ear	Tail	Head Width	Dewlap	Hind Limb	4th toe
♂	71	18.2		12	35	57	21
♂	71	18.2		11	34	57	21
♂	63	16.5	126	11	30	53	19
♀	64	16.5	104	11	11	53	19
♀	62	16...	112	10	11.5	45	19

We may conclude that *A. gadovii* differs sharply from *A. dunni*, aside from details of lepidosis, by its greater size and distinctive coloration.

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The Scientific Name of the American Smooth Green Snake

by KARL P. SCHMIDT AND WALTER L. NECKER
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The common smooth green snake of the northern and eastern United States was described in 1827 by Richard Harlan as *Coluber vernalis*. The first suggestions for a more restricted generic allocation were those of Baird and Girard in 1853 who placed it in *Chlorosoma*, and of Hallowell, in 1856 who placed it in *Herpetodryas*. Neither of these suggestions is at all tenable. *Chlorosoma* being an opisthoglyph snake of South America, and *Herpetodryas*, correctly spelled *Erpetodryas*, a synonym of *Chironius*, which includes large tropical American snakes with scales in even rows.

Günther, in the Catalogue of Snakes in the British Museum, in 1858, included *Coluber vernalis* in his new genus *Cyclophis*, which contained also *Coluber aestivus* Linnaeus (our rough green snake), the Javanese *Herpetodryas tricolor*, and three new species, *Cyclophis major* of China, *C. frenatus* of India, and *C. calamaria* of Ceylon. Generic names were already available for *Coluber aestivus* and *Herpetodryas tricolor*, namely *Opheodrys* and *Liopeltis*, both proposed by Fitzinger in 1843 and both monotypic. In 1860, Cope employed these generic names, placing *aestivus* in *Opheodrys*, and *vernalis*, with *tricolor* and Günthers *Cyclophis major* and *calamaria*, in *Liopeltis*.

Boulenger, in 1894, uniformly rejected Fitzinger's generic names of 1843, and divided up the species of *Cyclophis* under *Contia* Baird & Girard and *Ablabes* Dumeril and Bibron. The type of *Contia* is *Contia mitis* of western North America, and now not likely to be regarded as congeneric with our smooth green snake; and *Ablabes*, 1854, by the designation of *Coronella baliodeira* as type by Boulenger in 1890 becomes a strict synonym of *Gongylosoma* Fitzinger, 1843, which was based on this species. Cope again employs *Liopeltis* for the smooth green snake in 1900, and this name was accepted with-

out comment by Stejneger and Barbour for their Check List, having previously been employed by Stejneger for the Chinese and Loo Choo species in the "Herpetology of Japan" in 1907.

Cyclophis has been so much partitioned, and its species so much shuffled, that its revival would not contribute to nomenclatorial stability. In order to avoid the complicated question as to its type, we herewith designate the first species named by Günther, *Coluber aestivus* Linnaeus, as the type of *Cyclophis*. This places *Cyclophis* unequivocably as a synonym of *Opheodrys* Fitzinger.

Pope, in the preparation of his volume on the snakes of China (1935), had occasion to examine the generic affinities of the Chinese green snakes which had been referred to the genus *Liopeltis* by Stejneger in 1907. He concludes that *major*, *semicarinatus*, and *herminae*, with the addition of the South Chinese *multicinctus* Roux, and of the Burmese *doriae* Boulenger are allied to *vernalis*, but that they are *not* congeneric with the Javenese *Liopeltis tricolor*. His choice of the name *Eurypholis* Hallowell, based on the Loo Choo Island species *semicarinatus*, was unfortunate, since this name was established for a fossil fish ten years earlier, as has been called to our attention by Mr. Bryan Patterson of the Field Musuem staff, unfortunately after the appearance of the combination *Eurypholis vernalis* in our list of the amphibians and reptiles of the Chicago Area. Following Pope's zoological reasoning, it becomes necessary to find another name for the Chinese green snakes, as well as for the American *vernalis* and *mayae*.

The question as to the affinity of the American species *vernalis* with the Chinese forms on one hand and with the *Opheodrys aestivus* on the other is a zoological rather than a nomenclatorial one. The extensive series of genera represented by species in both eastern Asia and eastern North America predisposes to the conclusion that the American species are congeneric with the Chinese forms. Stejneger *in litt* suggests the reference of *vernalis* to *Opheodrys*, from whose type species, *O. aestivus* it has been distinguished chiefly by its smooth scales. Since the Chinese forms have weakly keeled scales, they bridge the gap between the two American species and support this suggestion. We therefore accept this solution and propose to refer to the smooth green snake as *Opheodrys vernalis* (Linnaeus). *Entechinus* Cope, type *Cyclophys major*, must be employed by those who do not agree with this generic arrangement. *Cyclophiops doriae* Boulenger, appears to be generically distinguishable on account of its entire anal plate, and *Ablabes hamptoni* of the same author should probably be associated with it.

This species of *Opheodrys* will therefore be:

O. aestivus (LINNAEUS)
O. herminae (BOETTGER)
O. major GUNTHER
O. mayae (GAIGE)
O. multicinctus (ROUX)
O. semicarinatus (HALLOWELL)
O. vernalis (HARLAN)

The Status of Crotalus unicolor Van Lidth de Jeude and Crotalus pulvis Ditmars*

by Howard K. Gloyd
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Van Lidth de Jeude's description (1887) of a unicolored variety of rattlesnake from the Island of Aruba, Dutch West Indies, seems to have been little noticed by herpetologists. It is an adequate description based upon several specimens, some of which were seen in life. About twenty years later, a rattlesnake from Nicaragua, similar to these, was described by Ditmars (1905) under the name of *Crotalus pulvis*. Still later (1910) Meek published brief notes on a rattlesnake from Aruba (FMNH 2637), referring it to the species *terrificus*. More recently Amaral (1927, p. 56; 1929, p. 4) expressed the opinion that the type specimen of *C. pulvis* is an albino *terrificus*.

Through the kindness of Dr. Thomas Barbour and Mr. Karl P. Schmidt it has been my privilege to examine the type of *pulvis* in the Museum of Comparative Zoology and the Aruba specimen in the Field Museum of Natural History. The close similarity of these snakes, not only in fundamental characteristics but also in many superficial respects, and their apparent distinctness from both *Crotalus durissus durissus* Linnaeus and *C. d. terrificus* (Laurenti) impressed me with the desirability of reopening the question of the status of *pulvis* and of *unicolor*.

Two possibilities of procedure present themselves. These peculiar specimens may be regarded (1) merely as aberrations of a sort occasionally met with among rattlesnakes, such as those described by Amaral (1927, *loc. cit.*) and the present writer (1935, p. 663), or (2) as representatives of a distinct form. In favor of the first is their similarity to *C. durissus* in the scutellation of the head and general body form. That they are not true albinos, however, is indicated by obvious presence of melanins in the skin, the dark eyes, and dark color of the tail. Furthermore, the number of similar specimens obtained from Aruba by different collectors and at different times (at least 4, and possibly 5), and the fact that no typical *durissus* have been reported from that island, seem to indicate something more significant than a fortuitous deviation from the normal.

In favor of the alternate possibility is the uniformity of these specimens in structural characters as well as the peculiar coloration, and their apparent distinctness from both *C. d. durissus* and *C. d. terrificus* not only in coloration but in their low number of ventrals (p. 66 in diagnosis) and small adult size. The last point was commented upon by Ditmars (*op. cit.*, p. 199) with whose conclusion

* Contribution from the Department of Zoology of the University of Michigan.

I am entirely in agreement for the following reason. The type of *pulvis* has an incomplete rattle of 6 segments and is 690 mm. long; the Aruba specimen in the Field Museum has a set of 9 segments, also incomplete, and is 955 mm. long. In both individuals the more anterior segments are approximately equal in size, indicating a decided retardation, if not cessation, of growth. Individuals of both *durissus* and *terrificus* of comparable dimensions show a conspicuous increase in the size of successively proximal segments indicative of continuous growth and submaximal development.

That these unicolored snakes may be ecologically distinct from *durissus* and *terrificus* is suggested by Ditmars' statement (*loc. cit.*) that his specimen was collected in a very dry sandy district, 20 miles inland from Managua, which would be decidedly removed from the west coastal plain of Nicaragua in which typical *durissus* is known to occur.

The discontinuity in the range of this form, if it be distinct, remains yet to be accounted for. The occurrence on Aruba of a species of *Leptodeira* having affinities with Central American and Yucatan forms (Ruthven, 1936) may indicate a relationship between the ophidian faunas of these regions.

In view of these considerations it seems desirable to regard the Aruba Island population as a valid species distinct from *durissus* and *terrificus*, reviving for it the name *unicolor* of Van Lidth de Jeude. Pending further knowledge of the rattlesnakes of Nicaragua, *Crotalus pulvis* Ditmars may be considered a synonym. The present status of this species, as understood by the writer, may therefore be summarized as follows:

Crotalus unicolor van Lidth de Jeude

Crotalus horridus, var. *unicolor* van Lidth de Jeude, 1887, Leyden Mus., 9:133 (Type locality Aruba, Dutch West Indies. Type specimen in Leyden Museum).

Crotalus pulvis Ditmars, 1905, Ann. Rep. New York Zool. Soc. (1904), 9:199, 4 figs. (Type locality 20 miles inland from Managua, Nicaragua. Type specimen MCZ 7044). Mocquard, 1909, Miss. Sci. Mex., pt. 3, no. 17, p. 971. Ditmars, 1910, Reptiles of the World, p. 354, pl. 86, lower fig.

Crotalus terrificus Meek, 1910, Field Mus. Nat. Hist. Publ., Zool. Ser., 7:416, Ruthven, 1923, Occ. Papers Univ. Michigan Mus. Zool., no. 143, p. 9. Amaral, 1927, Rev. Mus. Paulista, 15:8. Ibid., p. 56, fig. 4; 1929, Bull. Antivenin Inst. Amer., 3:4-5, (part); 1929, Mem. Inst. Butantan, 4:60; Barbour and Loveridge, 1929, Bull. Mus. Comp. Zool. 69:245.

Diagnosis—The characters which distinguish this species from *durissus* and *terrificus* are a generally gray coloration with a complete absence of pattern, except for a darker tail, and a low number of ventrals (males 160, 164, females 166, 167; *durissus* males 170-187; females 176-194; *terrificus* males 164-176, females 172-180).

Scutellation—A study of the two specimens which have been available to me and the data given by van Lidth de Jeude in his description of the material in the Leyden Museum yields the follow-

ing information on scutellation: dorsal scale rows 25-27-21, three lower lateral rows without keels at mid-body; ventrals range from 160 to 167 (2 males 160, 164; 2 females 166, 167); caudals 22 to 29 (2 males 28, 29; 2 females 22, 25), the distalmost divided in two cases. Supralabials 13 or 14; infralabials 13 or 14.

The rostral is higher than wide, acute at the apex, in direct contact with the anterior nasals. The top of the muzzle is covered by one pair of internasals, one pair of large prefrontals (anterior canthals), and a small postcanthal on each side. The frontal region is occupied by a pair of enlarged scales immediately back of the prefrontals; these are followed by smaller scales in transverse rows of 3 or 4 each. The scales of the parietal and upper temporal regions are strongly keeled, the lower temporals smooth. There are 2 loreals and 2 preoculars on each side; the postoculars are 3 or 4 in number. The lower anterior border of the orbit is occupied by a lacrimal slightly larger than the postoculars and 3 scales separate the eye from the supralabials. The first supralabials are in direct contact with the prenasals. The first infralabials are divided. There is one pair of chin shields about twice as long as wide, and 7 or 8 oblique rows of lateral gulars. MCZ 7044 has one slender submental and 2 small intergenials.

Form and Size—This species appears to be relatively more slender than *durissus*. The spinal ridge is fairly prominent. Van Lidth de Jeude states that one of his specimens was about 62 cm. long. Measurements of the two examined by me follow: FMNH 26378, Aruba, 955 mm. long, tail/total length ratio .101; MCZ 70448, Nicaragua, 690 mm. long, tail/length ratio .072.

Coloration—Both van Lidth de Jeude and Ditmars described the coloration from living material. The former states (p. 133) with reference to the type specimen that "it shows no sign of streaks behind the eye, nor any marking whatever. It is on the back of a uniform gray color, somewhat lighter on the ventrals; the very short tail is darker than the body, and its lower part of a bluish black color . . . Moreover, two specimens from Aruba are still living in the Zoological Gardens . . . at Amsterdam . . . One of them resembles the first mentioned specimen in color and in the total absence of any markings, the other is also of the same color, but shows on the back a trace of losenge-shaped spots. Both have the bluish black color on the lower surface of the end of the tail."

Ditmars (*loc. cit.*) says of the Nicaragua specimen: "The color is uniform pale, bluish-gray above, matching the tint of pumice-stone. There is practically no color pattern. Immediately after the epidermis has been shed, a chain of very obscure rhombs, of a slightly darker tint than the body color, may be discerned if the skin is distended. There are no traces of head-markings. The upper surface of the tail is of the same general color as the body. The

abdomen and first row of scales are pinkish-white, which tint is deeper on the outer edges of the gastrosteges."

Distribution—Aruba, Dutch West Indies: FMNH 2637; van Lidth de Jeude (1887). Nicaragua: 20 miles inland from Managua, MCZ 7044.

Affinities—In view of present knowledge of this species it can only be said that the nature of the scutellation of the head and the conspicuous spinal ridge suggests relationship with *durissus* and *terrificus*.

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